



# Vermont Codes Update Stakeholder Meetings

July 25 & 26, 2018  
White River Junction and Burlington, VT

<http://publicservice.vermont.gov/content/building-energy-standards-update>



# Code Update: Who

- ▶ Public Service Department, Planning and Energy Resource Division
  - Kelly Launder: Assistant Director
  - Keith Levenson: Energy Program Specialist
  - Barry Murphy: Evaluation, Measurement and Verification Program Manager
- ▶ Energy Futures Group (EFG)
  - Role: Project Management and Residential Lead
  - Who: Richard Faesy, Gabrielle Stebbins, Emily Bergan
- ▶ New Buildings Institute
  - Role: Roadmap, stretch code, national expertise
  - Who: Eric Makela, Jim Edelson

# Presentation Overview

1. Introduction
2. Setting the Stage
3. Roadmap to Net-Zero by 2030
4. Residential Code – Potential Updates
5. Q&A

This presentation and the recording of it will be posted on the PSD website:

<http://publicservice.vermont.gov/content/building-energy-standards-update>

# » Introduction

# Code Update: Why

- ▶ **30 V.S.A. § 51. (Residential Building Energy Standards)**
  - “After January 1, 2011, the commissioner shall ensure that appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC.”

# Code Update: Framework

## Multiple statutory requirements and policy goals pertaining to energy in Vermont:

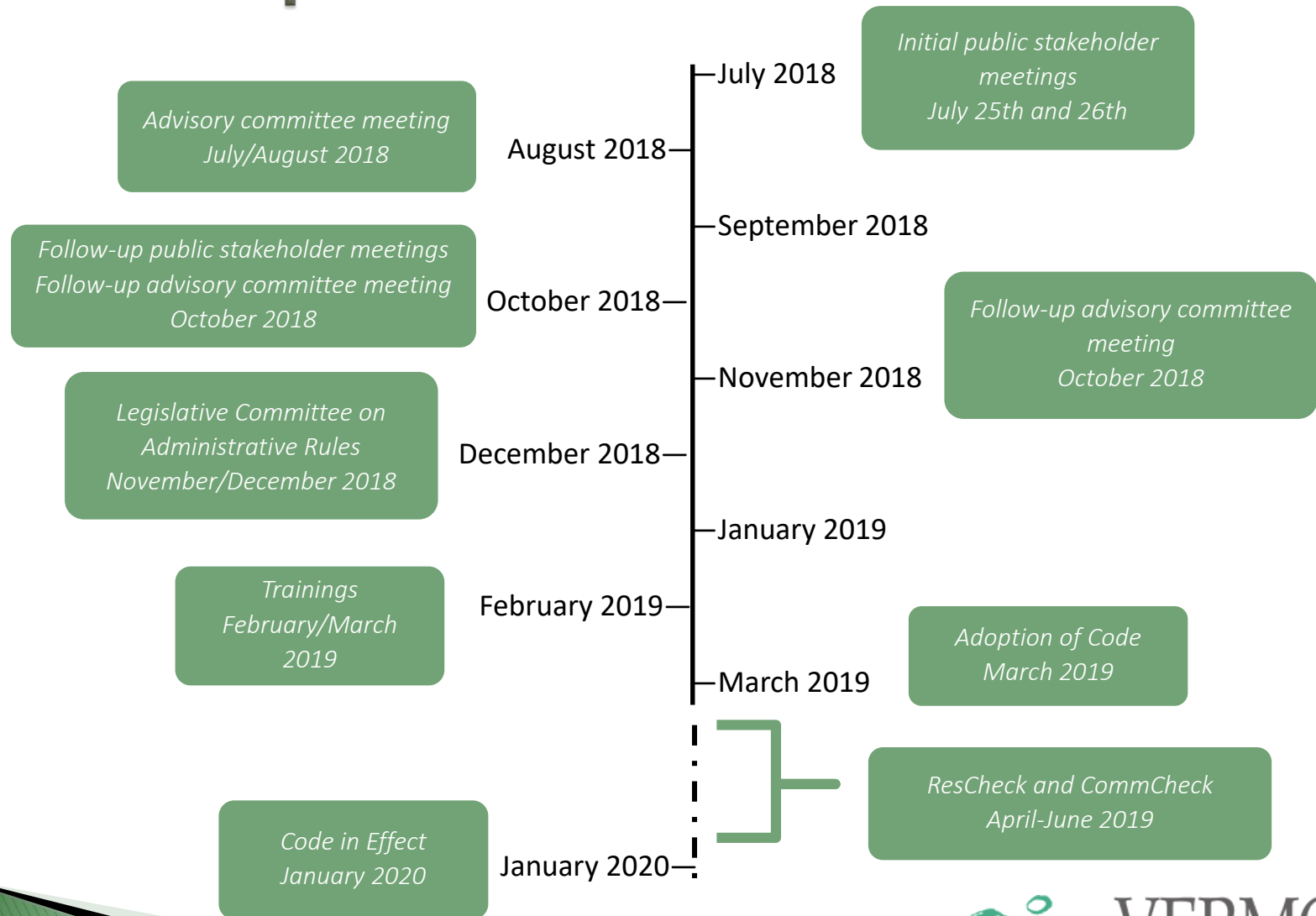
- ▶ 10 V.S.A. § 581 (building efficiency goals)
- ▶ 10 V.S.A. § 578 (greenhouse gas reduction)
- ▶ 30 V.S.A. § 8002–8005 (Renewable Energy Standard)
  - Additional net-metering (mostly solar)
  - Tier Three (requirement to shift from fossil fuels to electricity)
- ▶ Comprehensive Energy Plan (all new buildings designed to net zero by 2030)
- ▶ And more...resolutions and agreements regarding electric vehicles, limiting emissions, etc.

# Code Update: *New Framework*

These requirements and goals suggest a new framework for building energy code into 2030 (net zero is *\*not\** being proposed for *this* code update)

- ▶ Roadmap approach to new construction design to net zero by 2030
- ▶ Shift towards efficient electric heating
- ▶ Shift towards incorporating renewables (“solar ready”) and electric vehicle charging capabilities
- ▶ But still need to recognize federal pre-emption requirements that states can’t require higher standards than federal

# Code Update: Schedule





# Code Update: Advisory Committee

- ▶ Required by statute
- ▶ Technically-focused to do “deep dive” into code language
- ▶ Representation from:
  - Energy efficiency utilities
  - Architects
  - Builders
  - ASHRAE
  - Log Home Representative
  - Affordable Housing Representative
  - Insulators
  - State officials
  - Regional energy advocates
  - Trade associations (renewables, fuel dealers, building performance professionals)

# Code Update: Opportunity for Input

**\*\*The information presented today has not been decided upon; it is meant to initiate discussion\*\***

- ▶ Stakeholder meetings
  - July 25 – Hartford
  - July 26 – Burlington
- ▶ Advisory Committee meeting
  - August 2
- ▶ Follow up stakeholder meetings
  - October
- ▶ Follow up Advisory Committee meeting
  - October
- ▶ Opportunity for written comments throughout process

# »»Setting the Stage

# Code Update Process Scope

The code update process scope is focused on updating code language. It will not address issues such as enforcement.

Interested in addressing these issues?

1. Coordinate with one another
2. Decide on an approach to addressing these issues
3. Speak to your legislators

# Compliance Plan Progress

- ▶ 2012 Study: “Vermont Energy Code Compliance Plan – Achieving 90% Compliance by 2017”
- ▶ Progress to date:
  - Municipal coordination and support (Act 89 of 2013 and Efficiency Vermont “Municipal Guide”)
  - Ongoing coordination between Public Service Department and Department of Public Safety
  - Act 250 requires stretch code compliance
  - Efficiency Vermont provides code trainings and support
  - Builder licensing/registration efforts considered
  - Some lenders and closing attorneys require

# Market Baseline Studies

## Residential

- ▶ 74% technical compliance in 2011 with 2005 RBES
- ▶ A more recent study is in draft form – will be available soon

# Scoring of Potential Measures

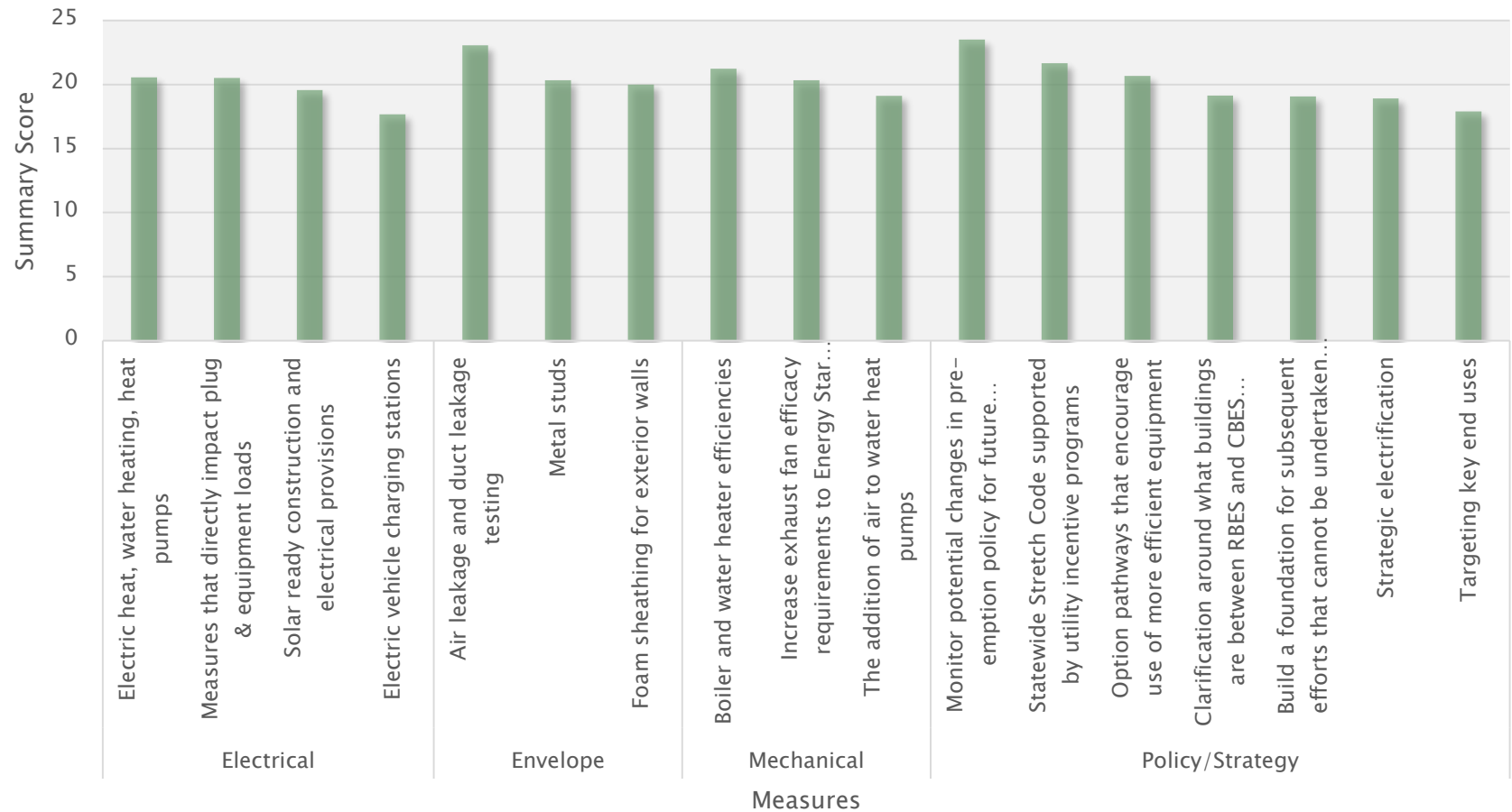
## ► Process

- Developed list of measures as a scoping exercise (prior to research)
- Developed scoring approach
- PSD, energy efficiency utilities and Advisory Committee invitees were requested to review

## ► Results

- All measures were considered important...so our presentation today shows a broad range of measures

# Residential Measure Scores by Measure Type





# Proposed Code Basis

- ▶ Residential
  1. Starting with 2015 RBES
  2. Adding in IECC 2018 changes (and other changes)
  3. After stakeholder and Advisory Committee process, adding in changes to reach 2019 RBES

# » Roadmap to Net-Zero by 2030

# Roadmap to Net-Zero

## Comprehensive Energy Plan (2011)

### ➤ Net-Zero Buildings Recommendation:

*“Consider and address the potential challenges for net-zero buildings in Vermont and complete recommendations for a clear path to achieve a goal of having all new buildings built to net-zero design by 2030. These recommendations will include the mechanisms that must be instituted to achieve such a goal (such as regulatory codes, energy codes, financing and incentives, and workforce training).”*

## Renewable Energy Standard (Act 56 of 2015) “Tier Three”

### ➤ Reduce fossil fuel usage; heat pumps; electric vehicles...

# Other states are moving in this direction (CA, MA, NY, OR, WA...)

## The New York Times

### *California Will Require Solar Power for New Homes*



Solar panels on a Southern California home. State law requires at least 50 percent of California's electricity to come from noncarbon-producing sources by 2030. David Paul Morris/Bloomberg

By Ivan Penn

May 9, 2018

SACRAMENTO — Long a leader and trendsetter in its clean-energy goals, California took a giant step on Wednesday, becoming the first state to require all new homes to have solar power.

- ▶ State officials and clean-energy advocates say the extra cost to home buyers will be more than made up in lower energy bills. That prospect has won over even the construction industry, which has embraced solar capability as a selling point.
- ▶ Under the new requirements, builders must take one of two steps: make individual homes available with solar panels, or build a shared solar-power system serving a group of homes.
- ▶ For residential homeowners, based on a 30-year mortgage, the Energy Commission estimates that the standards will add about \$40 to an average monthly payment, but save consumers \$80 on monthly heating, cooling and lighting bills.
- ▶ It requires new homes to have a solar-power system of a minimum 2 to 3 kilowatts, depending mostly on the size of the home.

# What is a Zero Energy Building?

A Zero Energy (ZE) building\* is highly energy efficiency and meets  $\geq 100\%$  of its annual energy from renewables.

- » **Energy** = All energy (electric, gas, steam, liquid fuel etc.) consumed on site
- » **Net** = One year or more of on-site renewable energy production minus energy use
- » **Verified** = A year or more of documented performance at net zero
- » **Emerging** = not yet a year or more of data (may be on a path to ZE)
- » **EUI** = Energy Use Intensity in kBtu/sf/yr - metric of energy performance.



\*Also known as Net Zero Energy (NZE), or Zero Net Energy (ZNE). Zero Energy Building (ZEB)



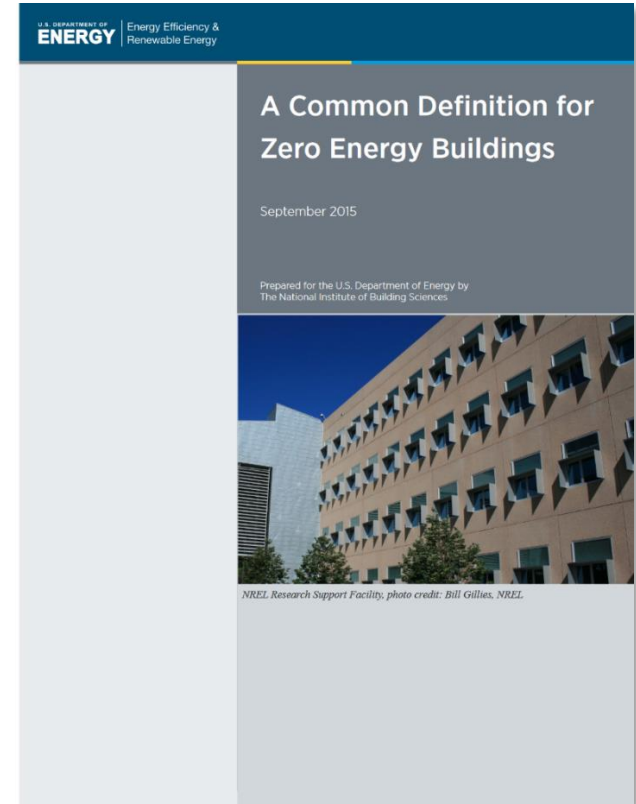
# Zero Energy Definitions

**DOE released A Common Definition for Zero Energy Buildings in September 2015:** A Zero Energy Building (ZEB) is an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

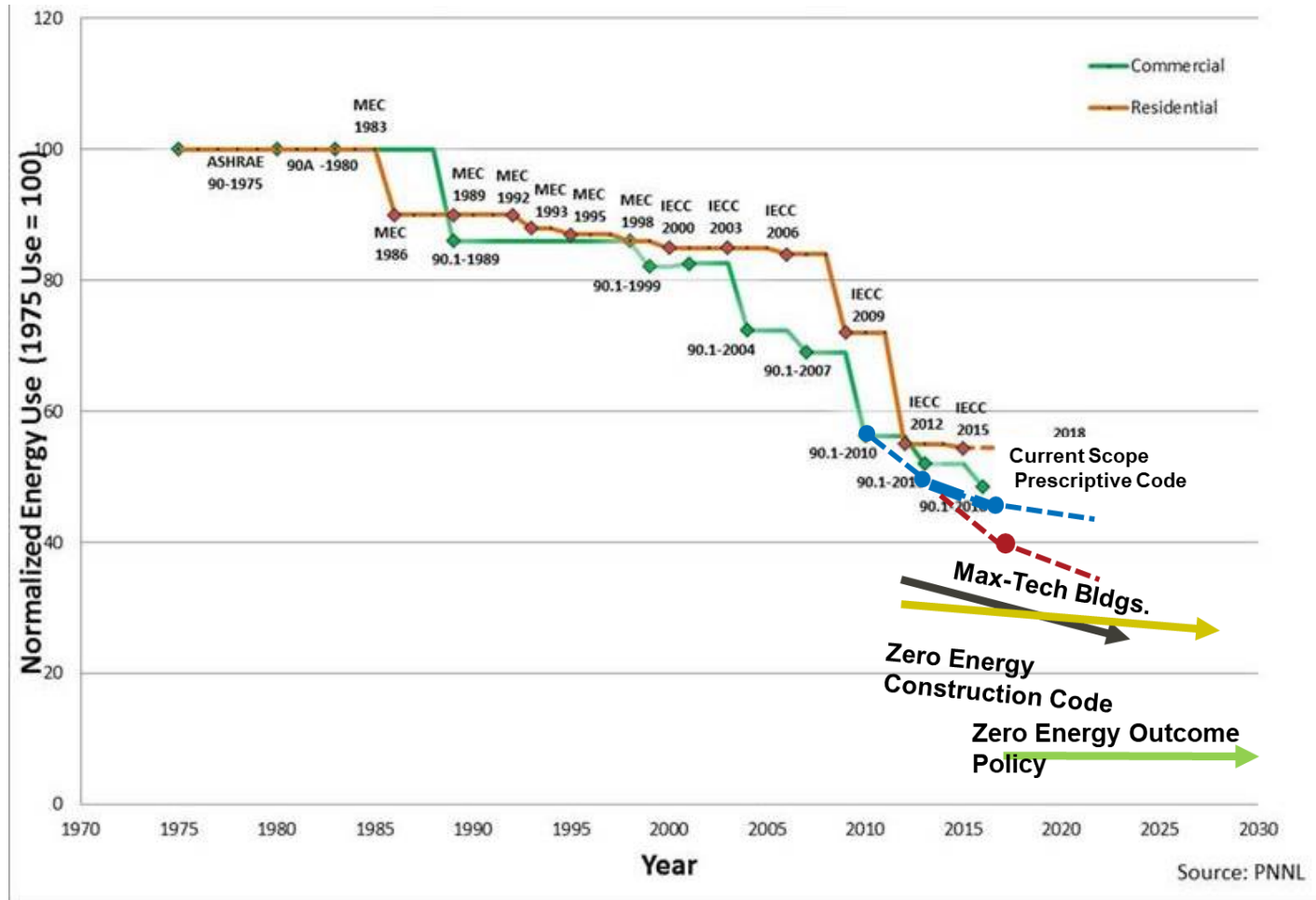
**CA DGS State Administrative Manual (SAM) Section 1815.31 ZNE Definition:** Energy Efficient building that produces as much clean renewable energy as it consumes over the course of a year, when accounted for at the energy generation source. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all fuel extraction, transmission, delivery, and production losses. By taking all energy use into account, the ZNE definition provides a complete assessment of energy used in buildings.

**New Buildings Institute Definition:** ZE buildings are ultra-low energy buildings that consume only as much power as is generated onsite through renewable energy resources over the course of a year.

Note: There will be a process to define “net zero” for Vermont (including biomass), starting with the Code Update Advisory Committee.



# Improvement in Model Energy Codes



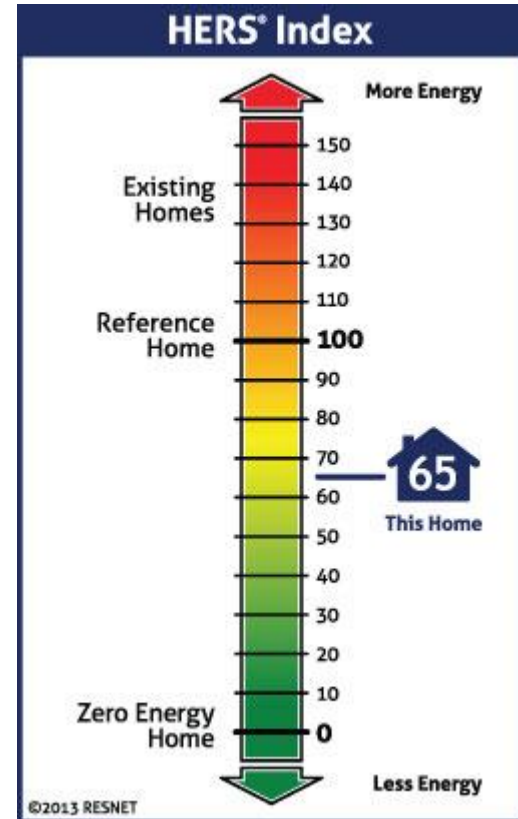
# Vermont Energy Efficiency Standards for Appliances and Equipment (Act 139 of 2018)

- Air compressors.
- Commercial dishwashers.
- Commercial fryers.
- Commercial hot-food holding cabinets.
- Commercial steam cookers.
- Computers and computer monitors.
- Faucets.
- High CRI fluorescent lamps.
- Portable air conditioners.
- Portable electric spas.
- Residential ventilating fans.
- Showerheads.
- Spray sprinkler bodies.
- Uninterruptible power supplies
- Urinals
- Water coolers.



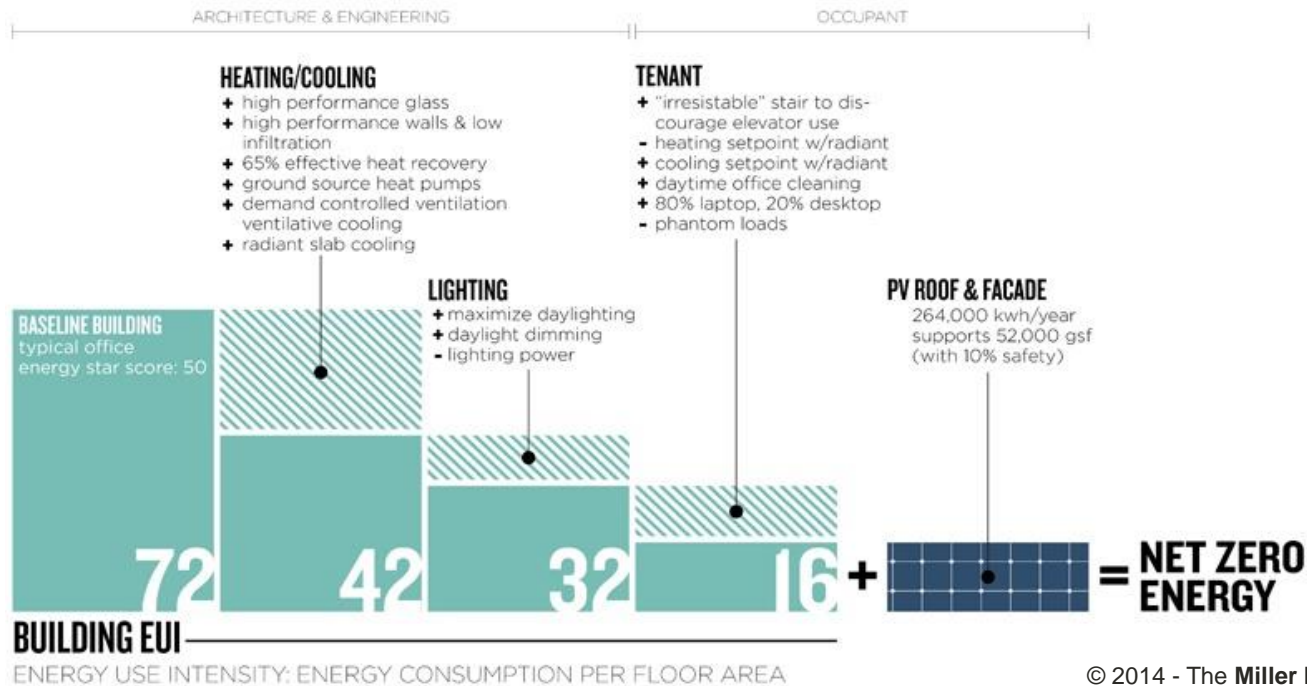
# Potential Approach to Roadmap: Step 1: Establish the Target

- Set absolute energy targets instead of simply “% better than code”
- Couple with other sustainability goals and policies (LEED, etc.)
- Could be established as Home Energy Rating System (HERS) or Energy Use Intensity (“EUI”; Btu/sq.ft.)



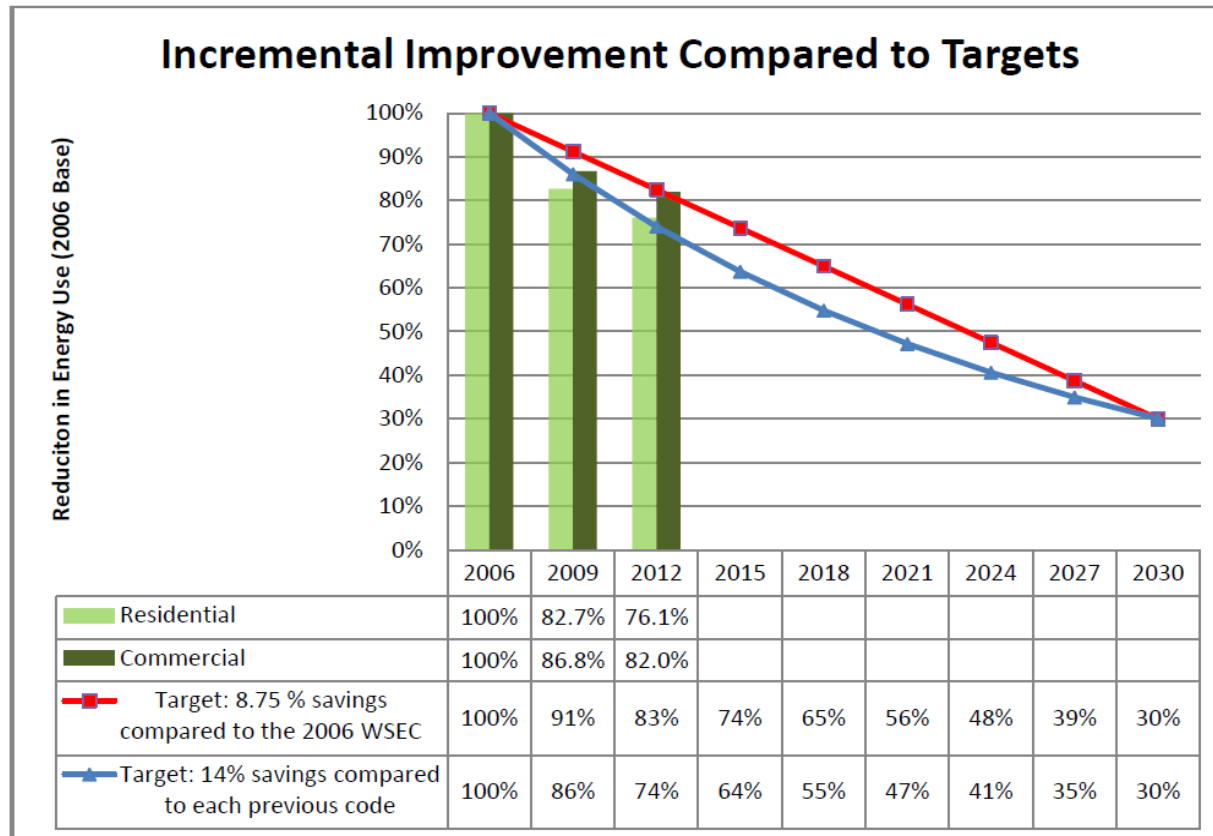
# Potential Approach to Roadmap: Step 2: Set Your Energy Target

- Begin by defining your energy target and solar budget

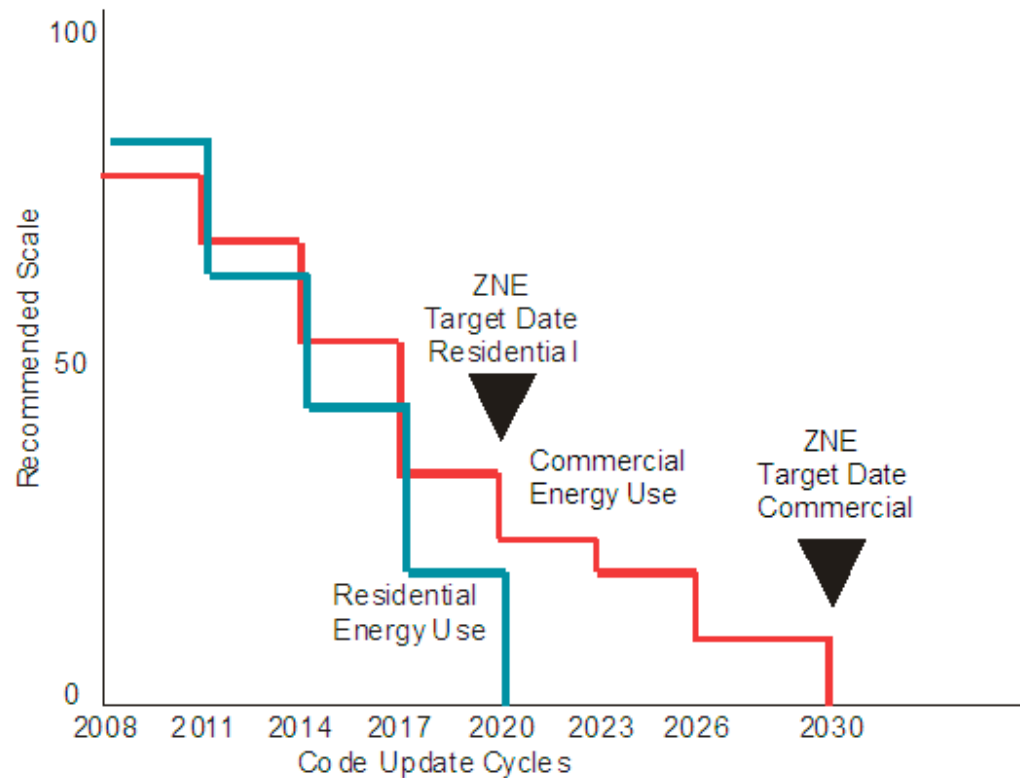


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# WA Code Improvement Targets



# CA Title 24 – The First ZNE Roadmap



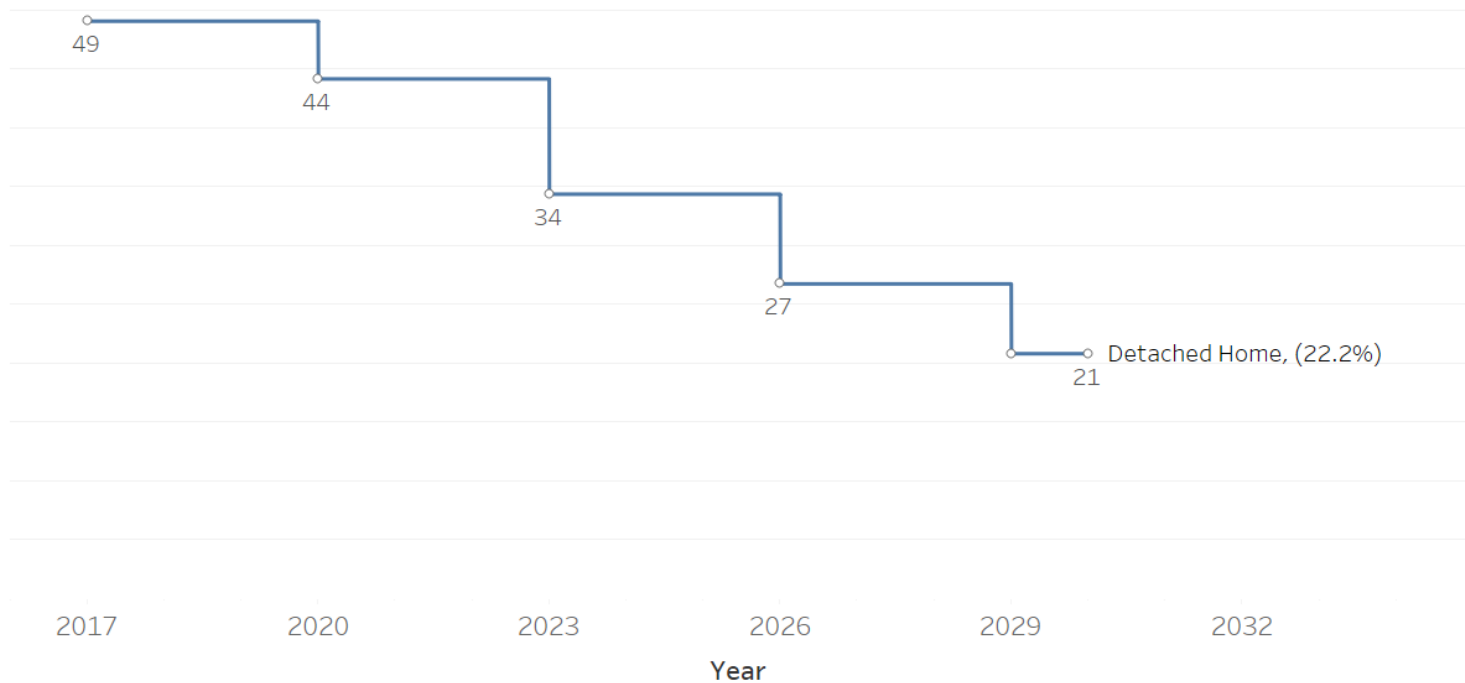
# For discussion:

## Site EUI targets to reach a ZE code in 2029 – Detached Home

Site EUI (kBtu/sf) targets to reach a zero energy code in 2029

2020: 10% Better than 2018 IECC

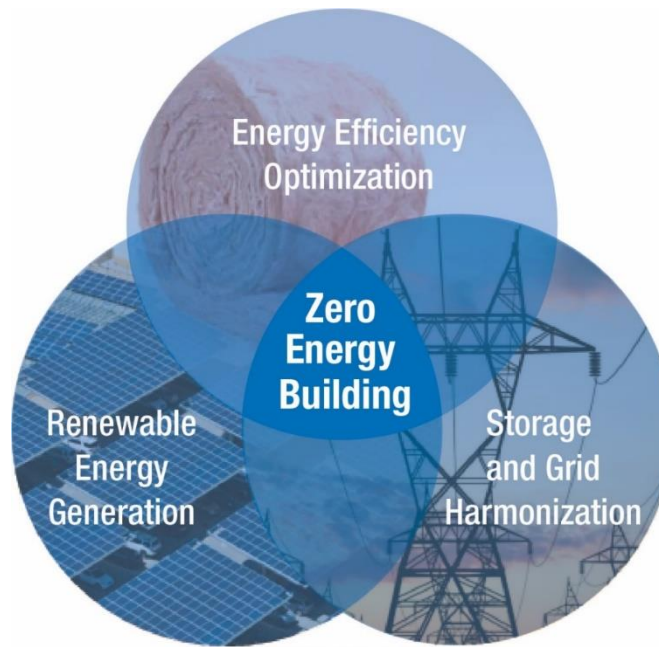
2020-2029: Constant percent savings



# Potential Target Code Performance Levels

Constant Percent Savings	
Year	Detached Home
2017	49.0
2020	44.1
2023	34.3
2026	26.7
2029	20.8
2020-2029 per cycle savings (%)	22.2%

# Complimentary Elements in ZNE



© 2017 New Buildings Institute

# » Residential



# Compliance Approach

- ▶ Federal Preemption Reminder
- ▶ Home Energy Rating System (HERS) and REScheck will still be in place
- ▶ Prescriptive Approach alternatives:
  - 2015 Approach: *Packages* (5 Base, 5 Stretch)  
Benefits to this approach: Simplicity  
Drawbacks: Restrictive
  - Proposed Approach: *Options* (Points, a la carte)  
Stretch works the same as Base, except more points chosen  
Benefits to this approach: Flexibility, decide your own tradeoffs  
Drawbacks: Learning curve

# Proposed Approach #1: Packages

- Similar to 2015
- 5 Base Packages, 5 Stretch Packages
- Combinations shown are modeled to be equivalent

# Proposed Approach #1: Packages

## BASE CODE

	Package 1 “Base”	Package 2 “2x8 or SPF wall”	Package 3 “SIPS”	Package 4 “Cavity only”	Package 5 “Thick wall”
Ceiling R-Value	R-49	R-60 attic / R-49 slope	R-28 cont.	R-60 attic / R-49 slope	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-25 cavity	R-21 cont.	R-20 cavity	R-20+12
Floor R-Value	R-30	R-30	R-30	R-30	R-30
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10	R-15 (cont)/ R-20 (cav)	R-20 (cont) / R-13+10	R-20 (cont) / R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft	R-15, 4 ft	R-15, 4 ft	R-10, 4ft
Heated Slab R-Value (Edge and Under)	R-15	R-15	R-15	R-15	R-15
Window and Door U-Value	0.30	0.22	0.30	0.30	0.30
Skylight U-Value	0.55	0.55	0.55	0.55	0.55
Air Leakage, ACH50	3.0	3.0	3.0	2.5	3.0
Duct Leakage	Inside thermal boundary	4 CFM25/100' CFA	Inside thermal boundary	Inside thermal boundary	4 CFM25/100' CFA
Ventilation	Exhaust only allowed	Exhaust only allowed	Exhaust only allowed	Balanced, SRE min. 75%	Exhaust only allowed
Lighting	90% LED	90% LED	90% LED	90% LED	90% LED

# Proposed Approach #1 : Packages

## STRETCH CODE

	Package 1a “Base”	Package 1b “Base”	Package 2 “2x8 or SPF wall”	Package 3 “SIPS”	Package 4 “Thick wall”
Ceiling R-Value	R-60 attic / R-49 slope	R-49	R-60 attic / R-49 slope	R-28 cont.	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20+5/ R-13+10	R-25 cavity	R-21 cont.	R-20+12
Floor R-Value	R-30	R-30	R-30	R-30	R-38
Basement/Crawl Space Wall R-Value	R-20 (cont)/ R-13+10	R-20 (cont) / R-13+10	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10	R-20 (cont) / R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft	R-15, 4 ft	R-15, 4 ft	R-15, 4ft
Heated Slab R-Value (Edge and Under)	R-15	R-15	R-15	R-15	R-15
Window and Door U-Value	0.27	0.27	0.22	0.27	0.27
Skylight U-Value	0.55	0.55	0.55	0.55	0.55
Air Leakage, ACH50	3.0 tested	2.5 tested	2.5 tested	2.5 tested	2.5 tested
Duct Leakage	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary
Heating / Cooling	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	Fed. min.
Hot water	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	Fed. min.
Ventilation	Exhaust only allowed	Balanced, SRE min. 75%	Balanced, SRE min. 75%	Balanced, SRE min. 75%	Balanced, SRE min. 75%
Lighting	90% LED	90% LED	90% LED	90% LED	90% LED

# Proposed Approach #2: Options

- New approach to provide more flexibility
- **Does not use Packages shown on previous slides**
- Base and Stretch met through choosing from Options menu after selecting one of two basic assembly packages

# Proposed Approach #2: Options

## BASE CODE

Choose one



Pick options to get required points

	Starter 1	Starter 2
Ceiling R-Value	R-49	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20 cavity
Floor R-Value	R-30	R-38
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft
Heated Slab R-Value (Edge and Under)	R-15	R-15
Window and Door U-Value	0.30	0.30
Skylight U-Value	0.55	0.55
Air Leakage, ACH50	3.0	3.0
Duct Leakage	4 CFM25/ 100' CFA	4 CFM25/ 100' CFA
Ventilation	EOV	EOV
Lighting	90% LED	90% LED

4 points for

< 1500 sf\*

5 points for

1500 to < 5000 sf\*

8 points for

> 5000 sf\*

**Points chart on following slide**

\*square footage determined by area within thermal envelope (e.g. unfinished basement included)

# Proposed Points/Options

4 points for  
5 points for  
8 points for

< 1500 sf\*  
1500 to < 5000 sf\*  
> 5000 sf\*

Category	Points value	
Envelope – Insulation	1	R-10 below entire slab
	1	AG walls R-21 cont. AND ceiling R-28 cont. (SIP or equiv.)
	2	AG walls R-20+12 (or equiv. u-factor wall assembly)
Envelope – Windows	1	Average u-factor $\leq 0.27$ <b>OR</b>
	2	Average u-factor $\leq 0.22$
Air Leakage and Ventilation	1	ACH50 is tested with blower door <b>OR</b>
	3	ACH50 $\leq 2.5$ (tested) and balanced H/ERV with 75% SRE, ECM
Heating and Cooling [for all of primary system]	1	ENERGY STAR: (1) Furnace AFUE 95, (2) Gas/Propane Boiler 90 AFUE, Oil Boiler 87 AFUE, (3) Heat pump HSPF 9.0; PLUS any AC is SEER 14.5 <b>OR</b>
	3	Advanced: Whole house heat/cool is (1) NEEP-listed heat pump combo, (2) GSHP, closed loop and COP 3.3, (3) ATWHP COP 2.5 and 120F design temp, (4) Advanced wood heating system
	1	All HVAC equipment and ductwork completely within air barrier and insulation envelope
DHW	1	ENERGY STAR, fossil fuel [EF 0.67 for $\leq 55$ gal; EF 0.77 for $> 55$ gal] <b>OR</b>
	2	ENERGY STAR, electric [EF or UEF 2.00 for $\leq 55$ gal; EF 2.20 for $> 55$ gal]
	1	All showerheads $\leq 1.75$ gpm, all lav. faucets $\leq 1.0$ gpm, and all toilets $\leq 1.28$ gpf
Strategic electrification	1	Home is PV-ready per DOE ZERH guidelines
	1	Level 2 electric vehicle charger installed in garage or primary parking area
	1	Min. 6 kWh grid-connected battery backup
	Up to 4	1 pt per 1.5 kW/housing unit of renewable generation on site (max 4 pts)

\*square footage determined by area within thermal envelope (unfinished basement included)

# How does it compare to Packages?

Starter 2
R-60 attic / R-49 slope
R-20 cavity
R-38
R-20 (cont)/ R-13+10
R-15, 4 ft
R-15
0.30
0.55
3.0
4 CFM25/ 100' CFA
EOV
90% LED

Example: R-20 cavity wall (Starter path 2) in 3500 sf home

- ▶ Package 4 gives you 1 way to build this wall and meet code (e.g. install HRV, 2.5 ACH50, keep ducts in thermal envelope)
- ▶ Under Options approach, you can do that (see Right) but you *can also* pick any number of alternative ways to get your 5 required points

Package 4 "Cavity only"
R-60 attic / R-49 slope
R-20 cavity
R-30
R-20 (cont) / R-13+10
R-15, 4 ft
R-15
0.30
0.55
2.5
Inside thermal boundary
Balanced, SRE min. 75%
90% LED

1 pt

3 pt

+1 pt  
for ESTAR boiler





# Examples

4 points for	< 1500 sf
5 points for	1500 to < 5000 sf
8 points for	> 5000 sf

1. 1200 sf home with R-20+5 walls. You need 4 pts. Here are some ways to get there:
  - Blower door test (1 pt) + R-10 under slab (1 pt) + ENERGY STAR furnace (1 pt) and ENERGY STAR hot water (1 pt)
  - Install 0.27 windows (1 pt) + heat pump water heater (2 pt) + all HVAC/ductwork in thermal envelope (1 pt)
  - Install 4.5 kW of PV on roof (3 pt) + 0.27 windows (1 pt)
2. 3500 sf home with R-20 walls. You need 5 pts. Here are some ways to get there:
  - Blower door test (1 pt) + ENERGY STAR furnace and water heater (2 pt) + 0.27 windows (1 pt) + all HVAC and ductwork in thermal envelope (1 pt)
  - Install HRV and test house to  $ACH50 \leq 2.0$  (3 pt) + ENERGY STAR furnace and water heater (2 pt)
  - Level 2 EV charger (1 pt) + 4.5 kW of PV in backyard (3 pt) + blower door test (1 pt)

\* The above examples are for illustrative purposes only. There are any number of measure combinations to reach the point requirements.

# Proposed Approach #2: Options

## STRETCH CODE

Choose one



	Starter 1	Starter 2
Ceiling R-Value	R-49	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20 cavity
Floor R-Value	R-30	R-38
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft
Heated Slab R-Value (Edge and Under)	R-15	R-15
Window and Door U-Value	0.30	0.30
Skylight U-Value	0.55	0.55
Air Leakage, ACH50	3.0	3.0
Duct Leakage	4 CFM25/ 100' CFA	4 CFM25/ 100' CFA
Ventilation	EOV	EOV
Lighting	90% LED	90% LED

+

Pick options to get required points

	Base	Stretch
< 1500 sf	4	5
1500 to < 5000 sf	5	7
> 5000 sf	8	10

\*square footage determined by area within thermal envelope (e.g. unfinished basement included)

# Examples [Stretch]

5 points for  
7 points for  
10 points for

< 1500 sf  
1500 to < 5000 sf  
> 5000 sf

1. 1200 sf home with R-20+5 walls. You need 5 pts. Here are some ways to get there:
  - Blower door test (1 pt) + R-10 under slab (1 pt) + ENERGY STAR furnace (1 pt) and ENERGY STAR hot water (1 pt) + **0.27 windows (1 pt)**
  - Install 0.27 windows (1 pt) + heat pump water heater (2 pt) + all HVAC/ductwork in thermal envelope (1 pt) + **Level 2 charger (1 pt)**
  - Install 4.5 kW of PV on roof (3 pt) + 0.27 windows (1 pt) + **blower door test (1 pt)**
2. 3500 sf home with R-20 walls. You need 7 pts. Here are some ways to get there:
  - Blower door test (1 pt) + ENERGY STAR ~~furnace and~~ water heater (1 pt) + 0.27 windows (1 pt) + all HVAC and ductwork in thermal envelope (1 pt) + **high efficiency heat pump (3 pt)**
  - Install HRV and test house to  $ACH50 \leq 2.0$  (3 pt) + ENERGY STAR furnace and water heater (2 pt) + **all HVAC/ductwork in thermal envelope (1 pt) + 0.27 windows**
  - EV charger (1 pt) + 4.5 kW of PV in backyard (3 pt) + blower door test (1 pt) + **heat pump water heater (2 pt)**

\* The above examples are for illustrative purposes only. There are any number of measure combinations to reach the point requirements.

# Other Measures to Address

Air leakage and duct testing	Clarify how measured, whether required
Ventilation alternatives	Add flexibility by considering <i>addition</i> of BSC 01 and Passive House standards to existing language; add text to allow demand-controlled systems; clarify ASHRAE 62.2 version and whether whole standard applies or just flow rate
Vapor retarder language	Clarify/update; consider adding flexibility re: smart/adaptive vapor retarders; more education in Code Handbook on situations to avoid
Window requirement	Clarify u-factor per IECC 2018
Lighting	Clarify 90% and efficacy requirements per IECC 2018
Combustion equipment (wood stoves)	Clarify requirement on doors and outdoor combustion air
Exhaust fan efficiency	Clarify requirement per IECC 2018
EV charging	Level 1 as Stretch requirement, Level 2 option pathway for Base/Stretch; clarify for MF and common parking areas
Residential vs. commercial	Clarify in Code Handbook
Electric heat	Clarify requirement; ref: Burlington code language
Programmable thermostats	Update language to accommodate cold climate heat pump controls
Air barrier / insulation	Update language per IECC 2018
Resiliency	Explore language

# Stakeholder Discussion –

## » Residential

# Discussion – Compliance Approach

- ▶ 2015 Approach: *Packages* (5 Base, 5 Stretch)

Benefits to this approach: Simplicity

Drawbacks: Restrictive

**Vs.**

- ▶ Proposed Approach: *Options* (Points, a la carte)

Stretch works the same as Base, except more points chosen

Benefits to this approach: Flexibility, decide your own tradeoffs

Drawbacks: Learning curve

# Discussion – Proposed Approach #1: Packages

## BASE CODE

	Package 1 “Base”	Package 2 “2x8 or SPF wall”	Package 3 “SIPS”	Package 4 “Cavity only”	Package 5 “Thick wall”
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Wood Frame Wall R-Value	R-20+5/ R-13+10	R-25 cavity	R-21 cont.	R-20 cavity	R-20+12
Floor R-Value	R-30	R-30	R-30	R-30	R-30
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10	R-15 (cont)/ R-20 (cav)	R-20 (cont) / R-13+10	R-20 (cont) / R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft	R-15, 4 ft	R-15, 4 ft	R-10, 4ft
Heated Slab R-Value (Edge and Under)	R-15	R-15	R-15	R-15	R-15
Window and Door U-Value	0.30	0.22	0.30	0.30	0.30
Skylight U-Value	0.55	0.55	0.55	0.55	0.55
Air Leakage, ACH50	3.0	3.0	3.0	2.5	3.0
Duct Leakage	Inside thermal boundary	4 CFM25/100' CFA	Inside thermal boundary	Inside thermal boundary	4 CFM25/100' CFA
Ventilation	Exhaust only allowed	Exhaust only allowed	Exhaust only allowed	Balanced, SRE min. 75%	Exhaust only allowed
Lighting	90% LED	90% LED	90% LED	90% LED	90% LED



# Discussion – Proposed Approach #1:

## Packages

### STRETCH CODE

	Package 1a “Base”	Package 1b “Base”	Package 2 “2x8 or SPF wall”	Package 3 “SIPS”	Package 5 “Thick wall”
Ceiling R-Value	R-60 attic / R-49 slope	R-49	R-60 attic / R-49 slope	R-28 cont.	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20+5/ R-13+10	R-25 cavity	R-21 cont.	R-20+12
Floor R-Value	R-30	R-30	R-30	R-30	R-38
Basement/Crawl Space Wall R-Value	R-20 (cont)/ R-13+10	R-20 (cont) / R-13+10	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10	R-20 (cont) / R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft	R-15, 4 ft	R-15, 4 ft	R-15, 4ft
Heated Slab R-Value (Edge and Under)	R-15	R-15	R-15	R-15	R-15
Window and Door U-Value	0.27	0.27	0.22	0.27	0.27
Skylight U-Value	0.55	0.55	0.55	0.55	0.55
Air Leakage, ACH50	3.0 tested	2.5 tested	2.5 tested	2.5 tested	2.5 tested
Duct Leakage	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary
Heating / Cooling	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	Fed. min.
Hot water	ENERGY STAR	ENERGY STAR	ENERGY STAR	ENERGY STAR	Fed. min.
Ventilation	Exhaust only allowed	Balanced, SRE min. 75%	Balanced, SRE min. 75%	Balanced, SRE min. 75%	Balanced, SRE min. 75%
Lighting	90% LED	90% LED	90% LED	90% LED	90% LED

# Discussion – Proposed Approach #2: Options

## BASE CODE

Choose one



Pick options to get required points

	Starter 1	Starter 2
Ceiling R-Value	R-49	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20 cavity
Floor R-Value	R-30	R-38
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft
Heated Slab R-Value (Edge and Under)	R-15	R-15
Window and Door U-Value	0.30	0.30
Skylight U-Value	0.55	0.55
Air Leakage, ACH50	3.0	3.0
Duct Leakage	4 CFM25/ 100' CFA	4 CFM25/ 100' CFA
Ventilation	EOV	EOV
Lighting	90% LED	90% LED

4 points for

< 1500 sf\*

5 points for

1500 to < 5000 sf\*

8 points for

> 5000 sf\*

**Points chart on following slide**

\*square footage determined by area within thermal envelope (e.g. unfinished basement included)



DEPARTMENT OF PUBLIC SERVICE

# Discussion – Proposed Points/Options

4 points for  
5 points for  
8 points for

< 1500 sf\*  
1500 to < 5000 sf\*  
> 5000 sf\*

Category	Points value	
Envelope – Insulation	1	R-10 below entire slab
	1	AG walls R-21 cont. AND ceiling R-28 cont. (SIP or equiv.)
	2	AG walls R-20+12 (or equiv. u-factor wall assembly)
Envelope – Windows	1	Average u-factor $\leq 0.27$ <b>OR</b>
	2	Average u-factor $\leq 0.22$
Air Leakage and Ventilation	1	ACH50 is tested with blower door <b>OR</b>
	3	ACH50 $\leq 2.5$ (tested) and balanced H/ERV with 75% SRE, ECM
Heating and Cooling [for all of primary system]	1	ENERGY STAR: (1) Furnace AFUE 95, (2) Gas/Propane Boiler 90 AFUE, Oil Boiler 87 AFUE, (3) Heat pump HSPF 9.0; PLUS any AC is SEER 14.5 <b>OR</b>
	3	Advanced: Whole house heat/cool is (1) NEEP-listed heat pump combo, (2) GSHP, closed loop and COP 3.3, (3) ATWHP COP 2.5 and 120F design temp, (4) Advanced wood heating system
	1	All HVAC equipment and ductwork completely within air barrier and insulation envelope
DHW	1	ENERGY STAR, fossil fuel [EF 0.67 for $\leq 55$ gal; EF 0.77 for $> 55$ gal] <b>OR</b>
	2	ENERGY STAR, electric [EF or UEF 2.00 for $\leq 55$ gal; EF 2.20 for $> 55$ gal]
	1	All showerheads $\leq 1.75$ gpm, all lav. faucets $\leq 1.0$ gpm, and all toilets $\leq 1.28$ gpf
Strategic electrification	1	Home is PV-ready per DOE ZERH guidelines
	1	Level 2 electric vehicle charger installed in garage or primary parking area
	1	Min. 6 kWh grid-connected battery backup
	Up to 4	1 pt per 1.5 kW/housing unit of renewable generation on site (max 4 pts)

\*square footage determined by area within thermal envelope (unfinished basement included)

# Discussion – Proposed Approach #2: Options

## STRETCH CODE

Choose one



	Starter 1	Starter 2
Ceiling R-Value	R-49	R-60 attic / R-49 slope
Wood Frame Wall R-Value	R-20+5/ R-13+10	R-20 cavity
Floor R-Value	R-30	R-38
Basement/Crawl Space Wall R-Value	R-15 (cont)/ R-20 (cav)	R-20 (cont)/ R-13+10
Slab Edge R-Value	R-15, 4ft	R-15, 4 ft
Heated Slab R-Value (Edge and Under)	R-15	R-15
Window and Door U-Value	0.30	0.30
Skylight U-Value	0.55	0.55
Air Leakage, ACH50	3.0	3.0
Duct Leakage	4 CFM25/ 100' CFA	4 CFM25/ 100' CFA
Ventilation	EOV	EOV
Lighting	90% LED	90% LED

+

Pick options to get required points

	Base	Stretch
< 1500 sf	4	5
1500 to < 5000 sf	5	7
> 5000 sf	8	10

\*square footage determined by area within thermal envelope (e.g. unfinished basement included)

# Discussion – Other Measures to Address

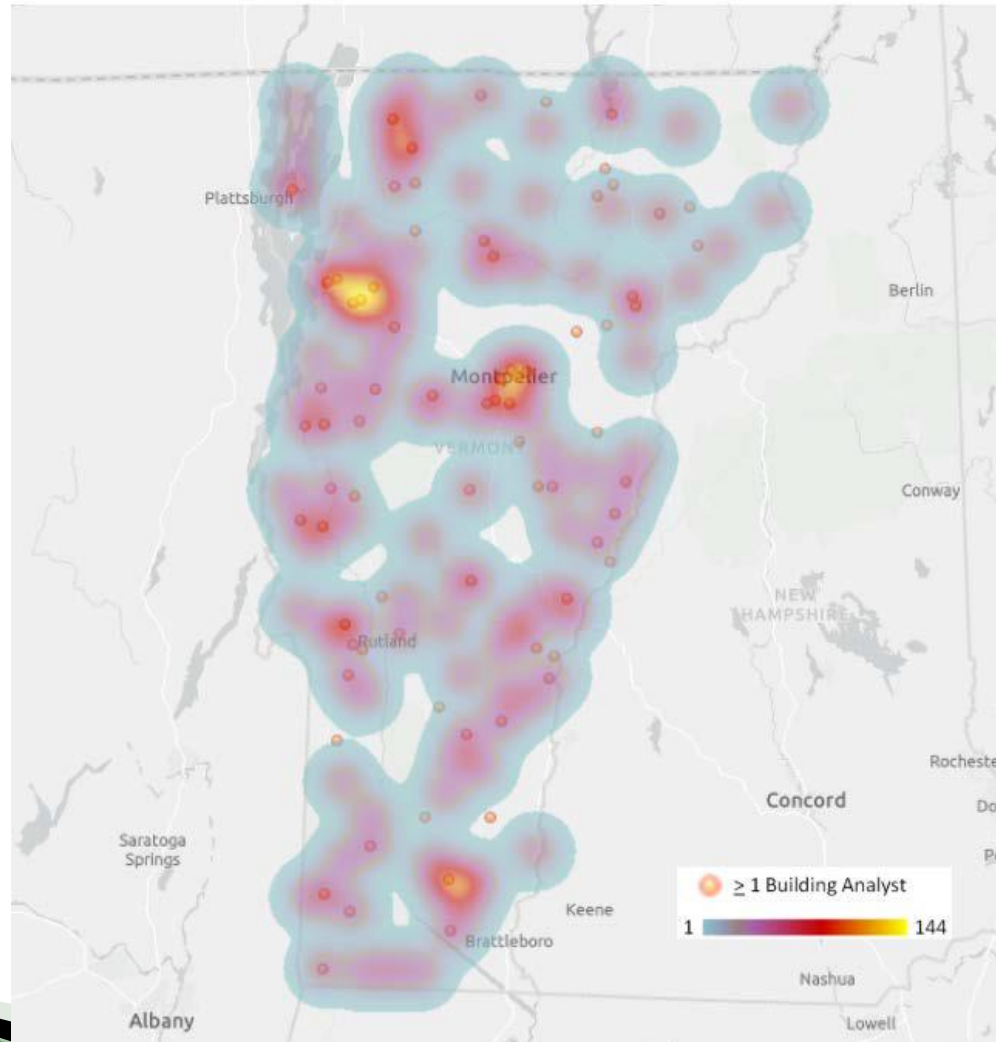
Air leakage and duct testing	Clarify how measured, whether required
Ventilation alternatives	Add flexibility by considering <i>addition</i> of BSC 01 and Passive House standards to existing language; add text to allow demand-controlled systems; clarify ASHRAE 62.2 version and whether whole standard applies or just flow rate
Vapor retarder language	Clarify/update; consider adding flexibility re: smart/adaptive vapor retarders; more education in Code Handbook on situations to avoid
Window requirement	Clarify u-factor per IECC 2018
Lighting	Clarify 90% and efficacy requirements per IECC 2018
Combustion equipment (wood stoves)	Clarify requirement on doors and outdoor combustion air
Exhaust fan efficiency	Clarify requirement per IECC 2018
EV charging	Level 1 as Stretch requirement, Level 2 option pathway for Base/Stretch; clarify for MF and common parking areas
Residential vs. commercial	Clarify in Code Handbook
Electric heat	Clarify requirement; ref: Burlington code language
Programmable thermostats	Update language to accommodate cold climate heat pump controls
Air barrier / insulation	Update language per IECC 2018
Resiliency	Explore language

# Discussion – Air Leakage and Duct Testing

- ▶ Reference: "The vast majority of states that have adopted the 2012/15 IECC require mandatory air leakage testing"
- ▶ Should performance testing be required?
- ▶ Blower door and duct testing?
- ▶ Interest, capacity and capability?
  - Building Performance Professionals Association letter and survey results
    - >100 certified professionals
    - 26 survey responses all confirmed interest
  - Efficiency Vermont letter of support
- ▶ Building permits and building analysts seem to generally align

# Building Permits & Building Analysts

Building Permits and Building Analysts per Town





# Discussion – Ventilation

- ▶ Add flexibility by considering *addition* of Building Science Corp 01 and Passive House standards to existing language;
  - BSC 01 – adjusts req'd flow rate from ASHRAE for balanced and/or distributed systems
  - PH – in most buildings, more stringent than ASHRAE
- ▶ Add text to allow demand-controlled systems;
- ▶ Clarify ASHRAE 62.2 version and whether whole standard applies or just flow rate

# Discussion – Vapor Retarder Language

- ▶ Clarify/update;
- ▶ Consider adding flexibility re: smart/adaptive vapor retarders;
- ▶ More education in Code Handbook on situations to avoid

# Discussion – Windows

- ▶ Max u-factor 0.30 per IECC 2018
- ▶ **R402.3.1 *U*-factor.**  
An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

# Discussion – Lighting

- ▶ Clarify 90% and efficacy requirements per IECC 2018
- ▶ **R404.1 Lighting equipment (Mandatory).**  
Not less than 90 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.

# Discussion – Wood Stoves

- ▶ Clarify requirement on doors and outdoor combustion air

# Discussion – Exhaust Fans Efficacy

- ▶ Update the requirements to the latest Energy Star requirement Version 4.0.
- ▶ Table R403.6.1 Whole House Mechanical System Efficacy

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY LEVEL (CFM/W)*	AIR FLOW RATE MAXIMUM (CFM)
Range Hoods	Any	2.8	Any
Bathroom and Utility Room Fans	10	<del>1.4</del> <u>2.8</u>	89
Bathroom and Utility Room Fans	90	<del>2.8</del> <u>3.5</u>	200
Bathroom and Utility Room Fans	201	<del>2.8</del> <u>4</u>	Any
In-Line (Single-Port & Multi-Port) Fans	Any	<del>2.8</del> <u>3.8</u>	Any
HRV or ERV	Any	1.2	Any

# Discussion – EV Charging

- ▶ Currently: Level 1 requirements for 10+ units for multi-family
- ▶ What is a reasonable increase?
- ▶ Potentially: For Stretch, a Level 2 (240 V) charger could receive 1 point via the options pathway?
- ▶ Or, is “Level 2 ready”, enough, for stretch?
- ▶ Discuss multi-family and common parking areas

# Discussion – Residential vs. Commercial

- ▶ Clarify delineations between building types
- ▶ Update code handbook to make it clearer which applies



# Discussion – Electric Heat

- ▶ Should Vermont adopt code language used by Burlington on resistance heat?

# Discussion – Programmable Thermostats

- ▶ Update language to accommodate cold climate heat pump controls

# Discussion – Air barrier / insulation

Update language per IECC 2018 (R402.4.1.1 on pR-34):

- ▶ Recessed lighting: Recessed lighting fixtures installed in the building thermal envelope shall be sealed to the finished surface.
- ▶ HVAC register boots: HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot
- ▶ Other

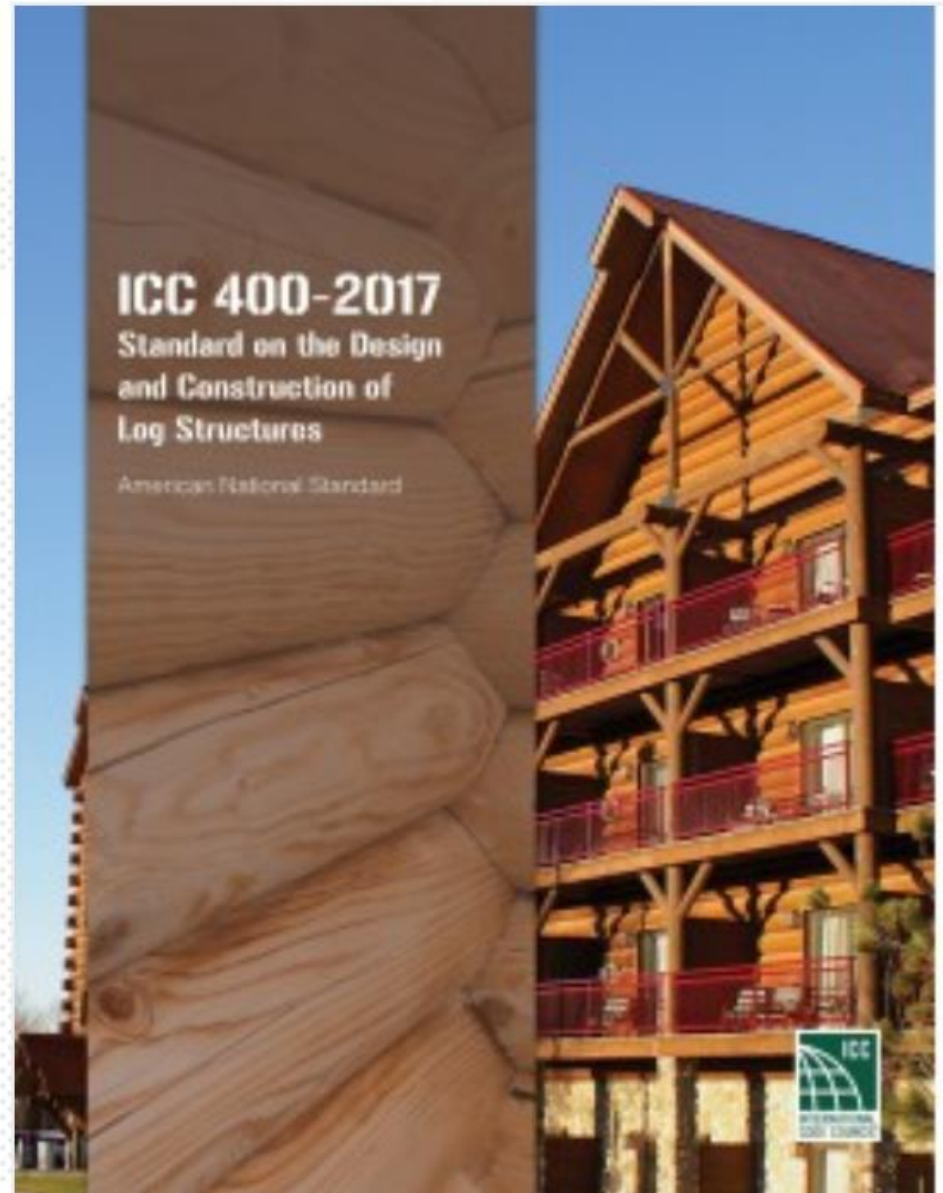
# Discussion – Resiliency

- ▶ Is this necessary in to include?
  - or
- ▶ Is it too soon to try to address for 2019?
- ▶ For example, what do stakeholders think “resiliency” means?
  - Energy storage?
  - Building durability?
  - Other?

# Discussion – Existing Homes

- ▶ Nothing new is being proposed; should it be?
- ▶ New base code levels will become the new standards
- ▶ Are R-values and U-factors reasonable?
- ▶ RBES Certificate use

# Log Homes



# In closing...opportunities to weigh in

**\*\*The information presented today has not been decided upon; it is meant to initiate discussion. Attend stakeholder meetings or send comments by July 31, 2018\*\***

What	Date	Time	Where
Webinar Overview	July 19 <sup>th</sup>	2:00 – 4:00 pm	On-line
Public Stakeholder Meeting	July 25 <sup>th</sup>	9:00 – 12:00 residential 12:30 – 3:30 commercial Lunch will be provided	Hartford Town Hall (& online) Room 2, 171 Bridge Street White River Junction
Public Stakeholder Meeting	July 26 <sup>th</sup>	9:00 – 12:00 residential 12:30 – 3:30 commercial Lunch will be provided	Burlington Electric Department Auditorium (& online) 585 Pine Street, Burlington
Webinar Overview and Two Public Stakeholder Meetings	October – dates TBD	TBD	TBD
Adoption of Code	March 2019 (estimated)		
Code in Effect	January 2020 (estimated)		



- Materials will be posted at <http://publicservice.vermont.gov/content/building-energy-standards-update>

# » Q&A

- Send future questions/comments to:
  - Residential focus: PSD.CodeUpdateRes@vermont.gov
  - Logistical comments/questions: [info@energyfuturesgroup.com](mailto:info@energyfuturesgroup.com) or Gabrielle Stebbins at 802-482-4014

